AMENDMENTS TO THE DRAWINGS:

The attached sheets of drawings includes changes to Figures 1, 6, and 7 where reference character "A" no longer designates a tank; reference character "B" no longer designates a tank; reference character(s) not mentioned in the description have been removed; and so that the scale and label for the ordinate for figures 6 and 7 is of good quality.

Attachment: Replacement Sheets

REMARKS

Claims 1-18 were examined.

Requirement for Information

The Official Action states that Applicant and the assignee of this application are required under 37 CFR 1.105 to provide the following information that the Examiner has determined is reasonably necessary to the examination of this application: copies of each publication which any of the Applicants authored or co-authored and which describe the disclosed subject matter of membranes.

The Official Action states that this requirement has been made because it appears that at least one of the inventors has published work particularly pertinent to the disclosed subject matter as detailed in the following rejection; that in responding to those requirements that require copies of documents, where the document is a bound text or a single article over 50 pages, the requirement may be met by providing copies of those pages that provide the particular subject matter indicated in the requirement, or where such subject matter is not indicated, the subject matter found in Applicant's disclosure.

The Official Action states that the Applicant is reminded that the reply to this requirement must be made with candor and good faith under 37 CFR 1.56. Where the Applicant does not have or cannot readily obtain an item of required

information, a statement that the item is unknown or cannot be readily obtained may be accepted as a complete reply to the requirement for that item; and that the fee and certification requirements of 37 CFR 1.97 are waived for those documents submitted in reply to this requirement.

In response to this requirement, attached to this amendment is a listing of articles of which any of the three Applicant inventors authored and which describe the disclosed subject matter of membranes.

Regarding published documents on the subject of membranes, Applicants note that membranes are a rather broad concept in this regard, and that the Applicants having written a large number of papers thereupon. Thus, in order to not swamp the patent authorities with a large number of irrelevant articles (such as for instance the present inventor May-Britt Hagg's articles regarding carbon membranes), enclosed a list of articles (the articles themselves being provided in an IDS) which they have filed on the subject of FSC-membranes and PY Am.

This submission is believed to fully comply with the Information Request.

Drawings

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character "A" has been used to designate both a tank and a gas flow line; reference character

"B" has been used to designate both a tank and a pressure indicator; they include the following reference character(s) not mentioned in the description; and because the scale and label for the ordinate for figures 6 and 7 is of poor quality.

In response thereto, the attached sheets of drawings includes changes to Figures 1, 6, and 7 where reference character "A" no longer designates a tank; reference character "B" no longer designates a tank; reference character(s) not mentioned in the description have been removed; and so that the scale and label for the ordinate for figures 6 and 7 is of good quality.

Specification

The disclosure was objected to because of the following informalities:

Page 9 line 33 of the specification has the phrase "AC" which was said to be unclear. The phrase "AC" indicates a complex compound as defined in "Basic Principles of membrane technology" as attached. In the matter in the present invention, this is the bicarbonate form HCO_3. The specification has been amended to clarify the AC means complex compound. No new matter is entered by this amendment.

Responsive, to the objection, the specification was amended to avoid referring to the listed references.

Claim Objections

Various claims were objected to because of the following informalities:

Claim 8 has the phrase "about, 50,000, for" which is unclear, since there are so many commas in the phrase;

Claim 13 has the phrase "swelling said polyvinylamine of said membrane by exposing said polyvinylamine ***for*** water vapor" which is unclear.

The informalities have been corrected by amendment.

No new matter is entered by the amendments or new claims.

Claim Rejections - 35 USC § 101

Claim 16 was rejected under 35 U.S.C. 101 because the claimed recitation of a use, without setting forth any steps involved in the process, results in an improper definition of a process, i.e., results in a claim which is not a proper process claim under 35 U.S.C. 101.

Claim 16 has been appropriately amended to comply with section 101. Withdrawal of the rejection is therefore solicited.

Claim Rejections - 35 USC § 112

Claims 2 and 17 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant

regards as the invention. The Official Action stated that the phrase "polyvinylamine comprises water" is unclear. This claim is cancelled without prejudice.

Claim 5 was rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. The Official Action stated that the phrase "cut-off" was unclear.

Applicant disagrees.

Cut-off is part of the recitation of a molecular weight cut-off (MWCO = Molecular Weight Cut Off) which refers to the lowest molecular weight of the molecule in which 90% of the molecule is retained by the membrane. Below this molecular weight, much less is being retained. This is generally related to porosity & pore size of the membrane support. This is a well-known term in the art, and should not in itself be unclear/indefinite.

Claim 6 is rejected under 35 U.S.C. 112, due to the phrase "such about" which is similar to "such as" and the phrase "for example" renders the claim indefinite because it is unclear whether the limitation(s) following the phrase are part of the claimed invention, and as to the MWCO recitation.

Claims 8 and 9 were rejected under 35 U.S.C. 112, second paragraph, due to the phrase "such as" and the phrase "for example" renders the claim indefinite because it is unclear

whether the limitation(s) following the phrase are part of the claimed invention.

Claims 6, 8, 9, 14, and 18 were rejected under 35 U.S.C. 112, second paragraph, due to a broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) is considered indefinite, since the resulting claim does not clearly set forth the metes and bounds of the patent protection desired.

Claim 14 was rejected under 35 U.S.C. 112, second paragraph, as being indefinite due to the phrase "such as" and the phrase "for example" renders the claim indefinite.

Claim 16 was rejected under 35 U.S.C. 112, second paragraph, as being indefinite as Claim 16 provides for the use of a membrane according to claim 1, but, does not set forth any steps.

Claim 18 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite due to the phrase "such as" and the phrase "for example" renders the claim indefinite.

The claims have been amended to remedy each of these issues. Withdrawal of the rejection is therefore solicited.

Claim Rejections - 35 USC § 103

I. Claims 1-4 and 7-18 were rejected under 35 U.S.C. 103(a) as being unpatentable over WANG et al. (CN-A-1363414) ("WANG") in view of Quinn et al. Membrane Science 1995, 104, 139-146 ("QUINN139"), Quinn et al. Membrane Science 1997, 131, 49-60 ("QUINN49"), Quinn et al. Membrane Science 1997, 131, 61-69 ("QUINN61") and the MERCK INDEX of "ammonium fluoride", as evidenced by the article entitled "Novel Fixed-Site-Carrier Polyvinylamine Membrane for Carbon Dioxide capture," and PINSCHMIDT, JR., et al. (US 4973410).

II. Claims 5-6 were rejected under 35 U.S.C. 103(a) as being unpatentable over WANG et al. (CN-A-1363414) ("WANG") in view of Quinn et al. Membrane Science 1995, 104, 139-146 ("QUINN139"), Quinn et al. Membrane Science 1997, 131, 49-60 ("QUINN49"), Quinn et al. Membrane Science 1997, 131, 61-69 ("QUINN61") and the MERCK INDEX of "ammonium fluoride", as evidenced by the article entitled "Novel Fixed-Site-Carrier Polyvinylamine Membrane for Carbon Dioxide capture," and PINSCHMIDT, JR., et al. (US 4973410) as applied to claims 1-4 and 7-18 above and further in view of Applicant admission on page 5 first paragraph of the instant specification.

III. Claims 8, 9, 14, 15, and 18 were rejected under 35 U.S.C. 103(a) as being unpatentable over WANG et al. (CN-A-1363414) ("WANG") in view of Quinn et al. Membrane Science 1995, 104, 139-146 ("QUINN139"), Quinn et al. Membrane Science 1997, 131,49-60 ("QUINN49"), Quinn et al. Membrane Science 1997, 131, 61-69 ("QUINN61") and the MERCK INDEX of "ammonium fluoride", as evidenced by the article entitled "Novel Fixed-Site-Carrier Polyvinylamine Membrane for Carbon Dioxide capture," and PINSCHMIDT, JR., et al. (US 4973410) as applied to claims 1-4 and 7-18 above, and further in view of Applicants admission on page 4 of the specification.

Traverse

First, cited publication 1: "Novel Fixed-Site Carrier Polyvinylamine Membrane for Carbon Dioxide Capture", Journal of Polymer Science, part B: Polymer Physics, 42, 4326-4336 (2004), Taek-Joong Kim, Baoan Li, May-Britt Hagg, was received by the publisher on March 23, 2004, as indicated on the front page of that publication, whereas the present patent application has a priority date from N020041199 filed 22 March 2004.

Therefore, this publication is not prior art to the present invention.

Wang et al. describes a method by which a polysulfone support is immersed into a polyvinylamine solution thus coating the support with same. However, as is evidenced by the document,

the methods of crosslinking is different, and in fact not comparable in any other sense than that crosslinking is conducted. Crosslinking polymers as such is a commonly known and is itself not inventive, nor do the inventors suggest that crosslinking alone is inventive.

However, the specific manner of crosslinking as shown in the present application has a number of beneficial consequences as it not only increases the strength of the membrane, but also greatly increases the throughput of CO_2 through the membrane. This is clearly shown in table 2, in which the influence of the crosslinking method itself is shown.

Surprisingly, the crosslinking with ammonium fluoride provides an increase of selectivity by a factor of 100, something which there was no reasonable expectation to see. Thus considered alone there is nothing to motivate the person skilled in the art to try this specific crosslinking method amongst others. (Evidence showing there was no reasonable expectation of success may support a conclusion of non-obviousness. In re Rinehart, 531 F, 2d 1048, 189 USPQ 143 (CCPA 1976))

Quinn et al. suggests a role for fluoride in the sense that Quinn et al. describe membranes in which fluoride is an integral part of the membrane itself. This is however a greatly different concept than using fluoride comprising compounds as crosslinkers.

Throughout the Examiner would seem to have somewhat misconstrued the transport of CO_2 through the membrane as in Quinn it is the effect of Fluoride ions which constitute the separative mechanism whereas in the present invention the fluoride comprising compound serves as a crosslinker to densify and strengthen the surface of the membrane.

Surprisingly, this densification and strengthening has resulted in great improvements in the selectivity. There is in fact nothing in the art which suggests using fluoride comprising compounds as crosslinkers. In fact, if the membranes according to Quinn were crosslinked it would seem as though the membranes might serve less well.

The separation mechanisms of Quinn in "New facilitated transport membranes for the separation of Carbon dioxide frOIl1 hydrogen and methane" (Journal of Membrane Science 104 (1995) 139·146) would conceivably not work if a crosslinker was applied to the molten salt which serves as the transport for the CO_2 molecules. Applying a cross linker to a molten salt is non-sensical as only polymers may be crosslinked.

In "Polyelectrolyte membranes for acid gas separations" Journal of Membrane Science 131 (1997) 49-60 there is mention of polymers, but again there is no mention of crosslinking apart from showing the negative effects of H_2S in decreasing the permeability of the membrane (page 58 second column).

Thus a person skilled in the art would in fact not be inspired to crosslink given Quinn, on the contrary the skilled person would be inspired to reduce crosslinking if possible.

This is also true for "Polyelectrolyte-salt blend membranes for acid gas separations", Journal of Membrane Science 131 (1997) pp. 61-69, in which a similar conclusion is drawn.

Hence, it is clear that one of skill would not be motivated to crosslink using fluoride comprising compounds as the teachings of the art teach away from this combination.

Nor does Pinschmidt comprise any evidence which would allow the skilled person to achieve or conceive of the result as shown in the present invention. Pinschmidt show that Polyvinylamine may be crosslinked, but this is in fact not relevant as any polymer may be crosslinked.

Reconsideration and allowance of all the claims are respectfully requested.

This response is believed to be fully responsive and to put the case in condition for allowance. Entry of the amendment, and an early and favorable action on the merits, are earnestly requested. Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Should there be any matters that need to be resolved in the present application; the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

YOUNG & THOMPSON

/Roland E. Long, Jr./

Roland E. Long, Jr., Reg. No. 41,949
209 Madison Street
Suite 500
Alexandria, VA 22314
Telephone (703) 521-2297
Telefax (703) 685-0573
(703) 979-4709

REL/lad

Appendix:

☒ - Page 347 of Basic Principles of membrane technology

☒ - Replacement Sheets for the Figures of the drawings

☒ - Information Disclosure Statement